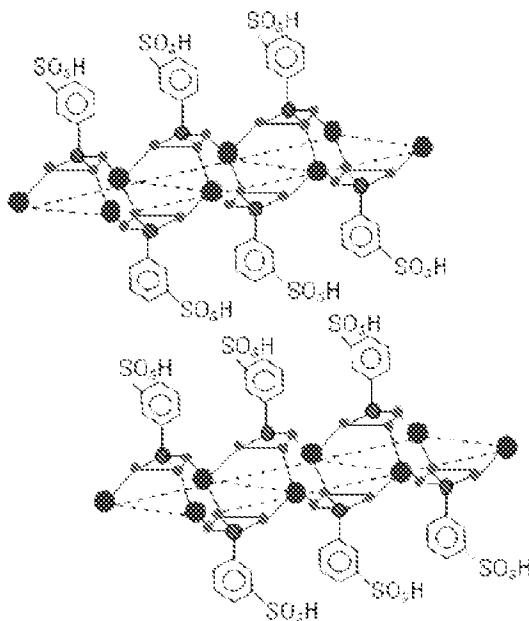


REMARKS

The Office Action mailed 7 June 2010, has been received and its contents carefully noted. The pending claims, claims 1, 2, 5, 6, 9 and 10, were rejected. By this amendment, claims 1, 5 and 7 have been amended. In particular, claims 1, 5 and 7 have been amended to cancel "ionomer/". Claim 5 has also been amended to improve its readability. Claim 1 has been amended to cancel the term "inserted". Applicants respectfully submit that canceling the term "inserted" does not change the scope or meaning of the claims. Claim 11 is newly added. Support may be found in the specification and the claims as originally filed. See, for example, Test Example 2, on page 13 of the specification as originally filed. No statutory new matter has been added. Therefore, reconsideration and entry of the claims as amended are respectfully requested.

The Claimed Invention

Applicants respectfully submit that the claimed invention employs a solid conductive material, i.e., metal phosphate, rather than an ionic liquid. As set forth in the claims, the present invention features a sulfoalkyl group or sulfoaryl group is inserted between the metal phosphate layers of the solid proton conductor wherein the sulfoalkyl group or sulfoaryl group forms a strong hydrogen bonding with the metal phosphate, and thereby maintaining the layer structure and thus increasing the thermal and chemical stability, and simultaneously the inserted material plays a role of transferring hydrogen ions and thereby increasing the conductivity. Thus, according to the present invention, the sulfoalkyl or sulfoaryl groups in the layered structures of the metal phosphate results in a crystalline structure which is schematically shown as follows:



● Zirconium ◊ Oxygen ◊ Phosphate

It should be noted that an ionic liquid is a liquid state composed of ionic (+, -) bonding. Thus, an ionic liquid in a membrane (such as that of Hennige) is easily removed and diluted in the presence of water, thereby significantly decreasing the conductivity of the membrane.

The membrane of the present invention, however, contains a solid proton conductor transferring proton (hydrogen ions) in the solid state. Since, the polymer membrane of the present invention adopts a hydrogen bonding of a sulfoalkyl or sulfoalkyl group to the metal (e.g., zirconium) phosphate (solid state), the proton is separated when the fuel cell works and the proton is transferred between the layered structure of the metal phosphate, which is not changed even in the presence of water.

Rejection under 35 U.S.C. 112, second paragraph

The Examiner rejected claims 1, 2, 5, 6, 9 and 10 under 35 U.S.C. 112, second paragraph, as being indefinite. Specifically, the Examiner deemed that the "ionomer/solid proton conductor" was unclear.

Applicants respectfully submit that the term "ionomer/solid proton conductor" is the same as a "solid proton conductor". Therefore, instances of "ionomer/solid proton conductor" have been changed to --solid proton conductor--.

Therefore, Applicants respectfully submit that the claims are clear and definite and the rejection under 35 U.S.C. 112, second paragraph, may be properly withdrawn.

Rejection under 35 U.S.C. 103(a)

The Examiner rejected claims 1–2, 5–6 and 9–10 under 35 U.S.C. 103(a) as unpatentable over Hennige (US 20040038105).

Applicants respectfully submit that Hennige does not teach or suggest the present invention as claimed. Specifically, the present invention is directed to a proton-conducting polymer membrane having a solid proton conductor having sulfoalkyl or sulfoaryl groups in metal phosphate layers of the solid proton conductor wherein the metal is a group IV metal. Hennige merely discloses conventional organic/inorganic ion-conducting materials. Nowhere does Hennige teach or suggest sulfoalkyl or sulfoaryl groups inserted in metal phosphate layers where the metal is a Group IV metal. According to the present invention, the metal in the metal phosphate layers is a Group IV metal, such as zirconium phosphate. Such a Group IV metal bonds to three oxygen atoms and forms a monoclinic system and the phosphate group located at the tetrahedral site functions as a cross linkage, thereby forming a layered structure. The phosphate group provides a space in which six water molecules can be held and the water molecules inserted between the layers form hydrogen bonds to P-OH groups, so that the layered structure is maintained by van der Waal's force. Accordingly, the layered metal phosphate has superior thermal properties and chemical resistance. If interlayer material is inserted, the distance between the layers increases, but the ion conductivity of the metal phosphate is improved because the inserted material helps proton transfer.

Hennige employs conventional organic/inorganic ion-conducting liquids. Nowhere does Hennige teach or suggest a solid proton conductor having sulfoalkyl or sulfoaryl groups inserted in metal phosphate layers wherein the metal is a group IV metal. Nothing in Hennige teaches or suggests that use of a Group IV metal in the layered structure would likely provide superior electrochemical properties and heat stability.

In addition, Hennige teaches that the use of an ionic liquid in the pores of the membrane, provides a membrane having good proton/cation conductivity even at temperatures above 100°C. Thus, the principal mode of operation of the invention of Hennige is by the ionic liquid in the

pores of the membrane. To modify the invention of Hennige to employ a solid proton conductor instead of an ionic liquid would change its principle mode of operation. It is improper to modify a prior art invention in a manner which changes its principle of operation. See MPEP 2143.01 and references cited therein. Thus, the invention of Hennige can not be modified to contain a solid proton conductor as set forth in the instant claims.

Therefore, Applicants respectfully assert that the claims, as amended, are unobvious and the rejection under 35 U.S.C. 103(a) should properly be withdrawn.

Request for Rejoinder

Applicants respectfully request rejoinder of the method claims, claims 7 and 8, which have been amended to be of similar scope to claim 1 (as claim 7 depends thereon) which is believed to be allowable.

Request for Interview

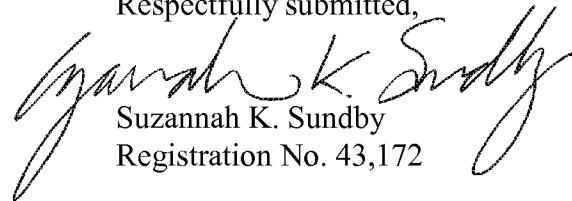
Either a telephonic or an in-person interview is respectfully requested should there be any remaining issues.

CONCLUSION

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Therefore, it is respectfully requested that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Official action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

It is not believed that extensions of time are required, beyond those that may otherwise be provided for in accompanying documents. However, in the event that additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. 1.136(a), and any fees required therefor are hereby authorized to be charged to **Deposit Account No. 024300**, Attorney Docket No. **034225.002**.

Respectfully submitted,



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